KAI XU

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Institute of Nanoscience and Nanotechnology
National Center for Scientific Research "Demokritos", Athens, Greece

RESEARCH INTERESTS

Multiscale heat transfer; thermal anisotropy; thermal characterization techniques; high hydrostatic pressure; Raman spectroscopy; microelectromechanical systems (MEMS); two-dimensional (2D) materials.

EDUCATION

24/09/2018 – 31/10/2023	**PhD in Materials Science** at Institute of Materials Science of Barcelona (ICMAB-CSIC) and Autonomous University of Barcelona (UAB), Barcelona, Spain. PhD thesis: *Contactless Frequency-domain Thermoreflectance (FDTR) Approaches to Study Thermal Anisotropic Materials* (Supervised by Dr. J. S. Reparaz, Dr. M. I. Alonso, and Prof. A. R. Goñi). Funded by **CSC scholarship**. Graduated ***cum laude*.**
01/09/2015 – 30/06/2018	**Master's degree in Materials Science and Engineering** at Wuhan University of Technology (WUT), Hubei, China. Average qualification of the academic record: 3.23 (0-4) MSc thesis: *Preparation and Modification of Li-Na-K Ternary Nitrate Heat Storage Materials* (Supervised by Prof. X. Cheng)
01/09/2011 – 30/06/2015	**Bachelor's degree in Inorganic Non-metallic Material Engineering** (*Excellent Engineer Class*) at Wuhan University of Technology (WUT), Hubei, China. Average qualification of the academic record: 3.30 (0-4).

RESEARCH EXPERIENCE

01/11/2025 – present	**Project researcher** (full-time) at INN/NCSRD**,** Project: ERC StG TheMA (supervision by Dr. Alexandros El Sachat)
16/06/2023 – 01/11/2025	**Project researcher** (full-time) at Institut de Ciència de Materials de Barcelona (ICMAB-CSIC), Barcelona, Spain. Project: **SOLS** (mentored by Prof. A. R. Goñi and Prof. M. Campoy-Quiles).

16/10/2022 – 31/05/2023 **Project researcher** (full-time) at Institut de Ciència de Materials de Barcelona (ICMAB-CSIC), Barcelona, Spain. Project: i**HEAT** (supervised by Dr. J. S. Reparaz).

SKILLS

- **Microfabrication**: Photolithography, reactive ion etching (RIE), focus ion beam etching (FIB), wet etching, and thermal evaporation deposition.
- Conventional **Morphology and structure characterization** techniques: Scanning electron microscopes (SEM), transmission electron microscopes (TEM), Powder X-ray Diffraction (XRD), and Profilometer.
- **Raman** spectroscopy: Including **polarized Raman** for determining crystal orientation and symmetry, **cryogenic** and **hydrostatic pressure** measurement.
- **Other spectroscopy** techniques: Fourier transform infrared (FTIR) spectroscopy, photoluminescence (PL) spectroscopy.
- **Thermal properties** characterization techniques: Differential scanning calorimeters (DSC) and thermogravimetric analyzers (TGA). **Frequency-domain thermoreflectance (FDTR) method and its multiple variations**. Transient thermal gratings method (TTG)
- **Numerical simulation software**: finite-difference time-domain (FDTD) for optical simulation and **thermal modeling** in COMSOL Multiphysics.
- Computer-aided design and manufacturing (**CAD** and **CAM**) softwares: Autodesk Fusion 360, AutoCAD, CleWin and Cura.
- Programming knowledge on **LabView**, Python, and Visual Basic.
- General laboratory skills, including the operation of vacuum circuitry and pumps, management of cryostats, and experience working in controlled environments such as cleanrooms and glove boxes.

PUBLICATIONS

163/247 citations, h-index of 8/10 (WoS/Google)

(22) Title: ***Microstructural Evolution Dominates the Changes in the Thermal Conductivity of Conjugated Polymers Upon Doping***

Authors: J. Guo, **K. Xu**, J. Asatryan, M. J. Alonso-Navarro, O. Zapata-Arteaga, M. Craighero, A. Perevedentsev, R. Kroon, M. M. Ramos, J. L. Segura, J. Martín, C. Müller, J. S. Reparaz, M. Campoy-Quiles

Journal: *Adv. Funct. Mater.*, *2025*, e10822., DOI 10.1002/adfm.202510822.

(21) Title: ***Unleashing the Impact of Topological Surface States on the Thermoelectric Properties of Granular Sb_2Te_3 Thin Films Deposited on Flexible Substrates***

Authors: L. Locatelli, P. Rossi, A. Kumar, C. Wiemer, A. Lamperti, R. Mantovan, G. Raciti, **K. Xu**, J. S. Reparaz, M. Caironi, G. Pace

Journal: *ACS Appl. Mater. Interfaces*, 2025, 17, 25, 37206–37215, DOI 10.1021/acsami.5c03871.

(20) Title: ***Preventing benzoquinone-based catalyst aggregation enables the one-step synthesis of highly conductive poly (benzodifurandione) without post-reaction purification***

Authors: J.-D. Huang, Q. Li, Q. Wang, T. Liu, S. Y. Jeong, S. H. K. Paleti, T. P. A. van der Pol, **K. Xu**, H.-Y. Wu, N. Pinchin, M.-A. Stoeckel, W. Jin, A. Perevedentsev, X. Liu, J. S. Reparaz, M. Campoy-Quiles, H. Y. Woo, C. Müller, M. Fahlman, C.-Y. Yang, S. Fabiano

Journal: *Adv. Mater.*, 2025, 37(17): 2502426., DOI 10.1002/adma.202502426.

(19) Title: ***Room-temperature anisotropic in-plane spin dynamics in graphene induced by $PdSe_2$ proximity***

Authors: J. F. Sierra, J. Světlík, W. Savero Torres, L. Camosi, F. Herling, T. Guillet, **K. Xu**, J. S. Reparaz, V. Marinova, D. Dimitrov, S. O. Valenzuela

Journal: *Nat. Mater.*, 2024, 24, 876–882, DOI 10.1038/s41563-024-02109-2.

(18) Title: ***Sign of the Gap Temperature Dependence in $CsPb(Br,Cl)_3$ Nanocrystals Determined by Cs-Rattler-Mediated Electron–Phonon Coupling***

Authors: S. Fasahat, N. Fiuza-Maneiro, B. Schäfer, **K. Xu**, S. Gómez-Graña, M. I. Alonso, L. Polavarapu, A. R. Goñi

Journal: *J. Phys. Chem. Lett.*, 2025, 16, 4, 1134–1141, DOI 10.1021/acs.jpclett.4c03491.

(17) Title: ***Absence of Anomalous Electron–Phonon Coupling in the Near-Ambient Gap Temperature Renormalization of $CsPbBr_3$ Nanocrystals***

Authors: S. Fasahat, B. Schäfer, **K. Xu**, N. Fiuza-Maneiro, S. Gómez-Graña, M. I. Alonso, L. Polavarapu, A. R. Goñi

Journal: *J. Phys. Chem. C.,* 2025, 129, 1, 453–463, DOI 10.1021/acs.jpcc.4c06265.

(16) Title: ***Unravelling the Origin of Thermal Anisotropy in $PdSe_2$***

Authors: **K. Xu**, L. Martínez Armesto, J. Svetlik, J. F. Sierra, V. Marinova, D. Dimitrov, A. R. Goñi, A. Krysztofik, B. Graczykowski, R. Rurali, S. O. Valenzuela, J. S. Reparaz

Journal: *2D Mater.*,2024, 11, 045006, DOI 10.1088/2053-1583/ad64e3.

(15) Title: ***On The Thermal Conductivity of Conjugated Polymers for Thermoelectrics***

Authors: X. Rodríguez-Martínez, F. Saiz, B. Dörling, S. Marina, J. Guo, **K. Xu**, H. Chen, J. Martin, I. McCulloch, R. Rurali, J. S. Reparaz, M. Campoy-Quiles

Journal: *Adv. Energy Mater.*, 2024, 2401705. DOI 10.1002/aenm.202401705.

(14) Title: ***Electrically Programmed Doping Gradients Optimize the Thermoelectric Power Factor of a Conjugated Polymer***

Authors: J. Liu, M. Craighero, V. K. Gupta, D. Scheunemann, S. H. K. Paleti, E. Järsvall, Y. Kim, **K. Xu**, J. S. Reparaz, L. J. A. Koster, M. Campoy-Quiles, M. Kemerink, A. Martinelli, C. Müller

Journal: *Adv. Funct. Mater.*, 2024, 34, 2312549. DOI 10.1002/adfm.202312549.

(13) Title: ***Upscaling Thermoelectrics: Micron-Thick, Half-a-Meter-Long Carbon Nanotube Films with Monolithic Integration of p-and n-Legs***

Authors: O. Zapata-Arteaga, B. Dörling, I. Alvarez-Corzo, **K. Xu**, J. S. Reparaz, M. Campoy-Quiles

Journal: *ACS Appl. Electron. Mater.*, 2024, 6, 5, 2978–2987. DOI 10.1021/acsaelm.3c01671.

(12) Title: ***Anomalous Electron–Phonon Coupling in Cesium-Substituted Methylammonium Lead Iodide Perovskites***

Authors: L. Pérez-Fidalgo, **K. Xu**, B. L. Charles, P. F. Henry, M. T. Weller, M. I. Alonso, A. R. Goñi

Journal: *J. Phys. Chem. C*, 2023, 127, 46, 22817–22826. DOI 10.1021/acs.jpcc.3c05995.

(11) Title: ***In-plane Thermal Diffusivity Determination Using Beam-offset Frequency-domain Thermoreflectance with a One-dimensional Optical Heat Source***

Authors: **K. Xu**, J. Guo, G. Raciti, A. R. Goñi, M. I. Alonso, X. Borrisé, I. Zardo, M. Campoy-Quiles, J. S. Reparaz

Journal: *Int. J. Heat Mass Tran.*, 2023, 214, 124376. DOI 10.1016/j.ijheatmasstransfer.2023.124376.

(10) Title: ***Impact of Oligoether Side-chain Length on the Thermoelectric Properties of a Polar Polythiophene***

Authors: M. Craighero, J. Guo, S. Zokaei, S. Griggs, J. Tian, J. Asatryan, J. Kimpel, R. Kroon, **K. Xu**, J. S. Reparaz, J. Martín, I. McCulloch, M. Campoy-Quiles, C. Müller

Journal: *ACS Appl. Electron. Mater.*, 2024, 6, 5, 2909–2916. DOI 10.1021/acsaelm.3c00936.

(9) Title: ***Room Temperature Spin-Phonon Coupling in Cr_2O_3 Nanocrystals***

Authors: M. Testa-Anta, J. N. Majcherkiewicz, **K. Xu**, A. R. Goñi, V. Salgueiriño

Journal: *Adv. Funct. Mater.*, 2023, 33, 2301973. DOI 10.1002/adfm.202301973.

(8) Title: ***Using Pressure to Unravel the Structure–dynamic-disorder Relationship in Metal Halide Perovskites***

Authors: **K. Xu**, L. Pérez-Fidalgo, B. L. Charles, M. T. Weller, M. I. Alonso, A. R. Goñi

Journal: *Sci. Rep.*, 2023, 13, 9300. DOI 10.1038/s41598-023-36501-w.

(7) Title: ***Highly Aligned Bacterial Nanocellulose Films Obtained During Static Biosynthesis in a Reproducible and Straightforward Approach***

Authors: N. Murugarren, S. Roig-Sanchez, I. Antón-Sales, N. Malandain, **K. Xu**, E. Solano, J. S. Reparaz, A. Laromaine

Journal: *Adv. Sci.*, 2022, 9, 2201947. DOI 10.1002/advs.202201947.

(6) Title: ***Design Rules for Polymer Blends with High Thermoelectric Performance***

Authors: O. Zapata-Arteaga, S. Marina, G. Zuo, **K. Xu**, B. Dörling, L. A. Pérez, J. S. Reparaz, J. Martín, M. Kemerink, M. Campoy-Quiles

Journal: *Adv. Energy Mater.*, 2022, 12, 2104076. DOI 10.1002/aenm.202104076.

(5) Title: ***Anisotropic Thermoreflectance Thermometry: A Contactless Frequency-domain Thermoreflectance Approach to Study Anisotropic Thermal Transport***

Authors: L. A. Pérez*, **K. Xu***, M. R. Wagner, B. Dörling, A. Perevedentsev, A. R. Goñi, M. Campoy-Quiles, M. I. Alonso, J. S. Reparaz

Journal: *Rev. Sci. Instrum.*, 2022, 93, 034902. DOI 10.1063/5.0066166.

(4) Title: ***Oscillatory Patterns in Redox Gradient Materials Through Wireless Bipolar Electrochemistry. The Dynamic Wave-like Case of Copper Bipolar Oxidation***

Authors: L. Fuentes-Rodríguez, E. Pujades, J. Fraxedas, A. Crespi, **K. Xu**, L. Abad, N. Casañ-Pastor

Journal: *Mater. Chem. Front.*, 2022, 6, 2284-2296. DOI 10.1039/D2QM00482H.

(3) Title: ***Study on Thermophysical Performance of Mg–Bi–Sn Phase-change Alloys for High Temperature Thermal Energy Storage***

Authors: D. Fang, X. Cheng, X. Ye, H. Wu, C. Zhang, **K. Xu**, N. Wang

Journal: *Vacuum*, 2020, 174, 109164. DOI 10.1016/j.vacuum.2020.109164.

(2) Title: ***Effect of Sol-gel Combustion Synthesis of Nanoparticles on Thermal Properties of KNO_3-$NaNO_3$***

Authors: Y. Huang, X. Cheng, Y. Li, D. Shi, G. Li, **K. Xu**

Journal: *Sol. Energy Mater. Sol. Cells*, 2018, 188, 190-201. DOI 10.1016/j.solmat.2018.09.006.

(1) Title: ***Effect of in-situ Synthesized nano-MgO on Thermal Properties of $NaNO_3$-KNO_3***

Authors: Y. Huang, X. Cheng, Y. Li, G. Yu, **K. Xu**, G. Li

Journal: *Sol. Energy*, 2018, 160, 208-215. DOI 10.1016/j.solener.2017.11.077.

GRANTED PATENTS

(2) Title: ***Device and method for thermal diffusivity analysis***

Authors: **K. Xu**, M. Campoy-Quiles, J. S. Reparaz

Reference: *European Patent Office* No. EP1641.1861

Significance: We describe a method to study the in-plane component of the thermal conductivity and thermal diffusivity of bulk and thin films. The method provides a novel approach which has enhanced sensitivity to in-plane heat flow (status: **licensed**)

(1) Title: ***Foldable multi-functional classroom desk and chair***

Authors: X.-K. Wang, **K. Xu**, Y. Chen, Y. Huang, X. Wang, S. Qin

Reference: *Chinese Patent.* No. CN203435921U. 2014.

Significance: The utility model describes a foldable, multifunctional classroom desk and chair featuring a simple structure and convenient use. It includes a control handle on a lifting floor, with hinged support bars that allow the desk and chair to be folded easily.